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ABSTRACT

Data from 80 junior high school students who completed the Assessment of Language and Reading Maturity (ALARM) test battery were used to delineate elements within the concept of mature reading comprehension. Stepwise multiple regression analyses were performed on the 15 ALARM test factors to isolate both the principal elements and the "trace elements" (overlooked factors/key relationships that nourish reading comprehension to mature levels) of mature reading comprehension. The principal elements in both mature reading comprehension and conventional reading comprehension were found to be abstract verbal reasoning, critical judgments-useful information, and critical judgments-reasonability. Of the five trace elements isolated, cultural/experiential compatibility, elaborative thinking, and general knowledge were concluded to be the most important of mature reading comprehension in junior high school students. The isolation of these trace elements was seen as a benchmark in the study of reading maturity, because the elements may have profound implications for indepth reading diagnosis and the selection of reading methodologies. (RL)

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A Multivariate Analysis of Principle and Trace Elements in 'Mature Reading Comprehension'

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The study of reading comprehension effectively has been reduced to its most frequent operational definition: some variation on recognition-recall of graded passages. This conventionalized and delimiting construct seems to be understood about as well as it can be from previous studies. The search for 'trace elements' in Conventional Reading Comprehension (CRC) would be unnecessary, for example, because it is a relatively crude construct. Spache and Spache (1975) have pointed out that recent factor analytic studies of reading comprehension, summarized, conclude that it consists of essentially three factors: a "word" factor, representing knowledge of word meanings; a "relationships" factor, reflecting the discernment of variously stated ideas; and a basic "reasoning" factor, referring to the drawing of direct conclusions and inferences.

Mature Reading Comprehension (MRC) is an alternate construct, more inclusive, and logically supportive of the intention of reading and education than is CRC. This study is addressed to the delineation of elements within MRC which are, and are not, "synonomous" with the conventionalized form of CRC, though undoubtedly are latent within it.

The term 'trace elements' is intended metaphorically, here, to suggest the slight, or overlooked, factors and/or key relationships necessary to nourish reading comprehension to mature levels. If such elements could be found in reading comprehension, these would be expected to parallel the role(s) of

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potassium, zinc, and iron, in providing for continuous growth and fine tuning of brain and muscular functions. The reasoning underlying this possible analog was simple: an identical passage read by persons of seemingly comparable ability causes some to gain informational weight, others to formulate ideas, and still others to be sparked to higher levels of critical and creative thought; therefore, there must be some less than obvious factors operating to cause some persons to metabolize essentially the same information more fully and expansively than others. Thus, we imagined that subfactors, or trace-elements, accounting for these puzzling differences were being drawn upon, and that the presence of these would become increasingly evident where fine tuning was required, as in critical-reading-thinking behavior, or mature reading comprehension.

Goals of the Study

One of the goals of this effort was to make the study of deeper levels of comprehension possible. To do so, comprehension was redefined as mature comprehension, and new relationships were projected which, if realized, would provide a significant level of validation for the new construct, and serve as a point of departure for subsequent inquiry into related questions, such as: are there optimal levels for certain elements, or factors (?); are there certain elements (or skills) which actually might be counter-effective at higher levels of intensity (?); are certain skills or elements needed in higher concentration at one stage of development than at another (?); and an array of related combinatorial questions, such as, what is the influence on certain skills and elements of environmental, temperamental, and situational factors (?).

This effort is part of a larger design to delineate better a concept and definition of overall reading maturity. Principally addressed in the larger

study, and reflected in the current study, are questions concerning the dynamics of continuous growth in reading, language, and learning, and the questions of whether these can be ferreted out for a given individual so as to be able to state that individual's peculiar mode of growth, as well as whether that individual is growing in a timely way. We refer to this more embracing construct as 'Progress Toward Reading Maturity' (PTRM) to distinguish it from previous and related efforts (Manzo and Casale, 1979).

The test factors employed in the current study of principle and possible trace elements in reading comprehension are the same as those fashioned for the larger study.

Definitions

Both conceptual and operational definitions of reading comprehension and of mature reading comprehension are provided, followed by a description, in the method section, of the test factors employed, and the data analysis procedures selected.

Conceptual definition of Conventional Reading Comprehension: literal, inferential, and applied (in the sense of simple transfer) understanding of written expository.

Operational definition of Conventional Reading Comprehension: score on Test #6, Conventional Reading Comprehension, of the battery of test factors called ALARM, or Assessment of Language and Reading Maturity, experimental form II (Manzo and Casale, 1979): a conventional recall based multiple choice question test on two brief passages (approximately 250 words in length, each), established to be of high interest to the intended audience. (This test had a .63 correlation with the Reading section of the Iowa Test of Basic Skills.)

Conceptual definition of Mature Reading Comprehension: all of the elements

of conventional reading comprehension plus, 1) indications of growth in awareness of the undergirth of precepts which tend to govern much of that which is thought and written, and 2) a willingness and ability to think evaluatively, and in a clear and emotionally unencumbered way, about these.

Operational definition of Mature Reading Comprehension (MRC): unweighted combined score of Test #6, General Reading Comprehension; and Test #15, Critical Judgments-Continuous Prose on the ALARM battery. The Critical Judgments-Continuous Prose test requires that judgments be expressed on certain aspects of a continuous passage regarding: a) the reasonability, judged against one's personal knowledge, of certain expressed views; b) the general usefulness, or value, of a certain piece of information toward better understanding of the topic of the passage; c) the internal logic of certain statements, d) the balance - or denotative/connotative appropriateness - of selected words and phrases. (Score on this test is an index of the extent of agreement expressed by the student with standards established from the responses of a group of mature readers who were forced to reach concensus upon each item.)

METHOD

Subjects

Eighty subjects were randomly selected from a medium large, urban, 7-8th grade junior high school. The school population appeared to be heterogeneous in terms of race, socio-economic background, and intellectual-academic levels.

Variables

The variables of the study were the fifteen test factors composing the ALARM battery (referenced above). These test factors are described briefly, and keyed to their abbreviated titles, in Table 1. Reliability and validity of the test factors have been established in previous papers, dissertation studies,

and articles (Manzo, 1975; Manzo, Lorton & Condon, 1975, 1977; Meeks, Eanet et. al., 1976; Robinson, 1977; Martin, 1978). Table 2 displays the intercorrelations among these test factors, and Table 3 lists the correlations of Mature Reading Comprehension (the sum of Conventional Reading Comprehension and Critical Judgments-Continuous Prose) with each of the ALARM test factors.

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insert Tables 1, 2, 3

Data Analysis

The delineation of principle and possible trace elements in Mature Reading Comprehension was conducted primarily through multiple regression analyses using a forward (stepwise) method for inclusion of independent variables. The objective of the analyses was to search for structural relations among the multivariate relationships presented in the ALARM test factors, rather than to select the fewest possible predictors. Therefore, the criterion values established for deciding which variables would enter into the solution were not restrictive. The F ratio of a variable to be entered on the upcoming step was set at .01. The tolerance level (T) was set at .1%: .1% of the variance of a potential variable had to be unexplained by previously entered predictors. Finally, the number of variables to be entered in the formation of the predictor list was unrestricted except by the F and T levels specified above.

Three stepwise multiple regressions were generated. The first two, for comparison purposes, were of Conventional Reading Comprehension (CRC) with all other ALARM test factors, and of Critical Judgments-Continuous Prose (CJCP) with all other ALARM test factors. The third was of Mature Reading Comprehension (MRC), the alternate construct, with all other ALARM test factors

(excluding CRC and CJCP which were summed to produce the MRC score).

Interpretation of the data essentially called for an examination of the list of variables generated for "best predictors" (principle elements); and then for "second order" predictors which had shown a low level of simple correlation with the criterion variable. It was reasoned that it would be this latter set of predictors which, if these could be isolated, potentially could be called 'trace elements'.

FINDINGS

Tables 4, 5, and 6 are summary tables for the stepwise multiple regressions performed. Criterion variables are specified as CRC, CJCP, and MRC, respectively. The summary tables list the test factors in the order of their predictive value. The increased correlation at each step is reported along with corresponding variance indices (R^2) and size of the variance change at each step (R^2 Change). Simple correlations are listed again in these tables, for convenience, with the Beta index provided as a measure of the size and direction of the effect of individual test factors at each step.

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insert Tables 4, 5, and 6

Criterion variable: Conventional Reading Comprehension (CRC)

58% of the variance explaining CRC was found in the ALARM battery, as shown in Table 4. 47% of this was explained by the test factor called Abstract Verbal Reasoning (AbstVR).

Critical judgment of the "usefulness" of certain statements of information (CJUI) constituted approximately 5% of the remaining variance in CRC. Ability to handle increasing Syntactic Complexity (SynCpx) accounted for an additional 2% of the variance, while Cultural and Experiential expectations of

school (CEComp), Vocabulary (Vocab), Elaborative Thinking (ElbThg), and Critical Judgments-Reasonability (CJR) accounted for the remaining 4% of the variance.

The three first selected predictors, AbstVR, CJUI, and SynCpx, had high and statistically significant simple correlations with CRC (.69**, .59**, and .58**). The remaining predictors showed either strong, medium, or no significant correlation with CRC: CEComp, .22*; Vocab, .45**; ElbThg, -.03; and CJR, .14.

Criterion variable: Critical Judgments-Continuous Prose (CJCP)

62% of the variance in the Critical Judgments-Continuous Prose test factor (CJCP) could be predicted from 8 of the 14 other ALARM test factors, as shown in Table 5. 50% of this variance could be predicted from the two other tests of critical judgments: 31% from Critical Judgments-Useful Information (CJUI), and an additional 19% from Critical Judgments-Reasonability (CJR). These two test factors had high simple correlations with CJCP (.56** and .54**).

The three next best predictors of CJCP each accounted for approximately 3% of its remaining variance. These were Abstract Verbal Reasoning (AbstVR), Cultural/Experiential Compatibility (CEComp), and Elaborative Thinking (ElbThg). AbstVR had a high simple correlation with CJUI (.53**), while CEComp and ElbThg each had relatively low simple correlations with CJUI (.20* and .11).

The remaining 4% of the variance accounted for was associated with General Knowledge (GenKnl), Word Recognition (WrdRec) and Syntactic Complexity (SynCpx). These predictors showed either strong, or no significant, correlation with CJCP: GenKnl, .30**; WrdRec, .17; and SynCpx, .47**.

Criterion Variable: Mature Reading Comprehension (MRC)

70% of the variance of the key factor under study, Mature Reading Comprehension (MRC), could be predicted from 8 of the ALARM test factors. Table 6 indicates that 42% of the variance in MRC could be predicted from Abstract Verbal Reasoning (AbstVR); 10% from evaluation of the reasonability of information (CJR); 8% from evaluation of the usefulness of information (CJUI); 3% from cultural and experiential compatibility with the expectations of school (CEComp); 2% from Elaborative Thinking (ElbThg); 2% from General Knowledge (GenKnl), and 1% each from Syntactic Complexity (SynCpx) and Word Recognition (WrdRec).

The first three best predictors, AbstVR, CJR, and CJUI had high simple correlations with MRC: .65**, .49**, and .64**. The simple correlations of MRC and CEComp, the next best predictor, was markedly lower, at .24*, but still statistically significant. The next best predictor, ElbThg, had a simple correlation with MRC of only .08, which was not statistically significant. The last 3 predictors each had a moderate to strong, and significant correlation with MRC: GenKnl, .29**; SynCpx, .57**; WrdRec, .25*.

RESULTS

The principle elements in Mature Reading Comprehension, as revealed in junior high school students, were Abstract Verbal Reasoning (AbstVR), Critical Judgments-Reasonability (CJR), and Critical Judgments-Useful Information (CJUI). Abstract Verbal Reasoning also was the single best predictor, or principle element, of Conventional Reading Comprehension, followed by CJUI. The principle elements in Critical Judgments-Continuous Prose were the other critical judgments test factors, CJUI and CJR.

The 'trace elements' revealed in Mature Reading Comprehension were: Cultural/Experiential Compatibility (CEComp), Elaborative Thinking (ElbThg),

General Knowledge (GenKnl), Syntactic Complexity (SynCpx), and Word Recognition (WrdRec). Each of these elements also had some discrete predictive power, at low levels (.03 - .01%), for Conventional Reading Comprehension (CRC) and for Critical Judgments-Continuous Prose (CJCP), except for Word Recognition, which was not predictive of CRC. The levels of contribution of these trace elements changed places in slight, though potentially significant ways. Most noteably, SynCpx was the third best predictor in CRC, the eighth in CJCP, and the seventh in MRC.

DISCUSSION AND CONCLUSIONS

Abstract Verbal Reasoning was the best predictor of both Mature Reading Comprehension and Conventional Reading Comprehension. This basic "thinking" factor appears to be a form of thinking which is compatible with, though in significant ways distinct from, critical-evaluative thinking. One form or another of the three critical judgments tests of evaluative thinking emerged as a principle element in MRC, and CRC.

This critical-evaluative-thinking factor in comprehension appears to be a form of awareness of the undergirth of factors, or precepts, which tend to govern much of what is written and thought. It appears to resemble strongly the Comprehension Subtest of the Wechsler Intelligence Scales for children and adults which is said to measure "practical judgments", "social acculturation" and "maturing conscience" or "moral sense" (Glasser & Zimmerman, 1967).

From a purely logical point of view, reading comprehension seems to make more sense when conceptualized, assessed and taught as a compound factor such as was represented by the addition of Critical Judgments factors to CRC. Most any educator, for example, could have written the following: "The pupil must constantly read to evaluate. The good comprehender is a critical reader. He checks the truth, logic, reliability, and accuracy of what is written...He

relates the material to his experience. He distinguishes fact from fiction..." (Dechant, 1965). In short, when an educator refers to "comprehension", the reference is to the breadth of it. It should not be necessary to qualify it by calling it Mature Reading Comprehension, the qualification more appropriately might be reserved for reference to anythi less than this.

Cultural/Experiential Compatibility, Elaborative Thinking, and General Knowledge were, upon reflection, concluded to be the important 'trace elements' in progress toward mature reading comprehension for junior high students. The reasoning behind this selection fell into two categories. 1) The presence of the CEComp and General Knowledge factors was a re-affirmation of several prior sociological, psychological, and educational studies which say that there is a fund of experiences and facts which sometimes appear to be non-critical in a given situation, though which become major predictors over the long term of academic, social, and reading-language development; e.g., magazines received in the home, and knowledge of seemingly trivial facts and allusions. 2) The discovery of the trace element Elaborative Thinking seemed a new and pregnant disclosure, with a certain logic to support its potential long term value as well: while divergent thinking might cause an individual to digress from the strict letter of the printed page, it could be argued that this is the sort of thinking which leads to the forming of ideas, sound judgments, heightened curiosity, and unwitting commitment to continual, or life long, learning... assuming of course that there is an adequate level of comprehension and that the digressions do not constitute a cronic form of emotional disruption.

The isolation of these 'trace elements' in Mature Reading Comprehension serves, at this point, as a benchmark in the study of reading maturity. There has been a certain degree of circularity in this extraction of elements which

were entered into a battery of tests with a preformed rationale. Even so, these results still are perhaps less redundant than those drawn solely from analyses of a simple recognition-recall test. They have provided support for the proposed analog of 'trace elements', which may prove to have profound implications for in depth reading diagnosis and selection of reading methodologies.

It is interesting, as a supportive aside, that Modified Cloze, a traditionally high correlary of conventional comprehension, was a relatively inconsequential factor in its prediction of Mature Reading Comprehension. This is not surprising, since it has been established previously that cloze performance is not a significant factor in the comprehension of meaning (Manzo and Culver, et.al., 1972), but more so is a measure of awareness of language redundancy patterns (Weaver and Kingston, 1963), a factor which probably has a clear optimal value, and, therefore, a period when it probably is best taught, thereafter being useful for quick measurement purposes, but nonproductive as an instructional intervention strategy.

The use of cloze for the measurement of CRC was justified solely upon its high correlations with CRC. Cloze did not correlate well with more profound measures of meaning and other related reading factors; it also proved to be of little value in the improvement of reading comprehension (Martin, 1967). Critical Judgments Continuous Prose (CJCP), however, is highly correlated with CRC (.68), and MRC (.96), as well as with other significant reading factors. On this basis, it appears as if CJCP might be as appropriate for measurement, and more promising as an intervention strategy, for general reading comprehension.

It appears, in conclusion, that one major obstacle to the more profound

understanding of reading comprehension has been a certain timidity in stating what it is which needs to be combined to represent the construct more properly. The tendency has been to overvalue factors which correlate highly with conventional reading comprehension and to undervalue or dismiss those which do not. Other, more logically based, methods seem to be necessary as well. In short, the study and understanding of reading comprehension probably will progress better if we select task(s) to represent it which are more sympathetic to the complexities of the process.

Table 1
Descriptors, and Brief Descriptions of
ALARM Test Factors

1. WrdRec: basic word analysis, or, WORD RECOGNITION
2. Vocab: selection of VOCABULARY synonyms
3. Analog: reasoning with basic ANALOGIES
4. SynCpx: translation of sentences of increasing SYNTACTIC COMPLEXITY
5. ModClz: MODIFIED CLOZE passage completion
6. CRC: CONVENTIONAL READING COMPREHENSION as measured by multiple choice response
7. GenKnl: GENERAL KNOWLEDGE, or range of facts and information
8. AbstVR: Application of ABSTRACT VERBAL REASONING to interpret proverbs
9. ElbThg: inclination toward ELABORATIVE THINKING
10. SEFac: SOCIAL/EMOTIONAL Factors, primarily appetitive motivation and emotional stability
11. TLRang: breadth of TEACHING/LEARNING RANGE
12. CEComp: degree of CULTURAL/EXPERIENTIAL COMPATIBILITY with expectations of school
13. CJUI: CRITICAL JUDGMENTS-USEFUL INFORMATION, evaluative estimates of the relative value of certain facts and ideas
14. CJR: CRITICAL JUDGMENTS-REASONABILITY, evaluative estimates of the reasonability of certain statements
15. CJCP: CRITICAL JUDGMENTS-CONTINUOUS PROSE, evaluation of various specified elements of continuous prose

Table 2
Intercorrelations for 15 ALARM Subtests
and Total ALARM Score
N = 80

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
1 WrdRec	1.00															
2 Vocab	.28**	1.00														
3 Analog	.45**	.51**	1.00													
4 SynCpx	.40**	.51**	.52**	1.00												
5 ModClz	.44**	.45**	.46**	.65**	1.00											
6 CRC	.37**	.45**	.44**	.58**	.50**	1.00										
7 GenKnl	.22*	.10	.17	.15	.27**	.10	1.00									
8 AbstVR	.35**	.47**	.48**	.66**	.62**	.69**	.19*	1.00								
9 ElbThg	-.13	-.19	-.02	-.21*	-.03	-.03	.00	-.07	1.00							
10 SE:Fac	.32**	.35**	.28**	.28**	.30**	.21*	.21*	.26**	.10	1.00						
11 TLrang	.12	.03	-.04	.13	.03	.11	.09	.08	.06	.03	1.00					
12 CEComp	.14	-.03	.12	.13	.08	.22*	-.18	.09	-.08	-.16	.03	1.00				
13 CJUI	.34**	.44**	.58**	.51**	.50**	.59**	.08	.61**	-.09	.17	.10	.23*	1.00			
14 CJR	.15	.16	.12	.33**	.31**	.14	.31	.27**	.00	.28**	.12	-.11	.23*	1.00		
15 CJCP	.17	.26**	.35**	.47**	.45**	.44**	.30**	.53**	.11	.19*	.14	.20*	.56**	.54**	1.00	
ALARM	.36**	.31**	.44**	.51**	.50**	.58**	.21*	.56**	-.00	.22*	.14	.73**	.61**	.25*	.65**	1.00

*p < .05
**p < .01

Table 3
Correlations of Mature Reading Comprehension (MRC)
with ALARM Test Factors
N = 80

WrdRec	.25	ElbThg	.08
Vocab	.35	SEFac	.31
Analog	.42	TLRang	.15
SynCpx	.57	CEComp	.24
ModClz	.53	CJUI	.64
CRC	.68	CJR	.49
GenKnl	.29	CJCP	.96
AbstVR	.65	TOTAL	.71

Table 4
Multiple Regression Summary
For Conventional Reading Comprehension on ALARM Test Factors

Variable	Multiple R	R^2	R^2 Change	Simple R	Beta
AbstVR	.69	.47	.47	.69**	.40
CJUI	.72	.52	.05	.59**	.22
SynCpx	.73	.54	.02	.59**	.20
CEComp	.74	.55	.01	.22*	.11
Vocab	.75	.56	.01	.45**	.13
ElbThg	.75	.57	.01	-.03	.10
CJR	.76	.57	.01	.14	-.12
WrdRec	.76	.58	.00	.37**	.09
Analog	.76	.58	.00	.44**	-.10
CJCP	.76	.58	.00	.44**	.04
SEFac	.76	.58	.00	.21*	.02
ModClz	.76	.58	.00	.50**	-.03
GenKnl	.76	.58	.00	.10	.02
TLRang	.76	.58	.00	.11	.01

* $p < .05$

** $p < .01$

Table 5
Multiple Regression Summary
For Critical Judgments-Continuous Prose on ALARM Test Factors

Variable	Multipler	R^2	R^2Change	Simpler	Beta
CJUI	.56	.31	.31	.56**	.32
CJR	.70	.49	.19	.54**	.37
AbstVR	.72	.52	.03	.53**	.16
CEComp	.74	.55	.03	.20*	.21
ElbThg	.76	.58	.03	.11	.16
GenKnl	.77	.60	.02	.30**	.19
WrdRec	.78	.61	.01	.17	-.16
SynCpx	.79	.62	.01	.47**	.11
TLRang	.79	.62	.00	.14	.02
Vocab	.79	.62	.00	.26**	-.03
GRC	.79	.62	.00	.45**	.04
SEFac	.79	.62	.00	.17	.02

* $p < .05$

** $p < .01$

Table 6
Multiple Regression Summary
For Mature Reading Comprehension on ALARM Test Factors

Variable	Multipler	R^2	R^2Change	Simpler	Beta
AbstVR	.65	.42	.42	.65**	.27
CJR	.73	.53	.10	.49**	.27
CJUI	.78	.61	.08	.64**	.34
CEComp	.80	.64	.03	.24*	.21
ElbThg	.81	.66	.02	.08	.17
GenKnl	.82	.68	.02	.29**	.17
SynCpx	.83	.69	.01	.57**	.16
WrdRec	.83	.70	.01	.25*	-.10
TLRang	.83	.70	.00	.15	.02
SEFac	.83	.70	.00	.21*	.02
Analog	.83	.70	.00	.42**	-.03
Vocab	.83	.70	.00	.35**	.01
ModClz	.83	.70	.00	.53**	-.01

* $p < .05$

** $p < .01$

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